ISSUE 1 / 2016

INFORMATION – RESOURCES – ENERGY

CUTEC News

HAPPY NEW YEAR 2016

EDITORIAL

...ADOPTING NEW APPROACHES

It is perhaps a little unusual that the author of this issue's cover story is not a qualified scientist. We think it can be interesting to adopt new approaches in this as in other respects, allowing a different perspective to be presented.

The end of a financial year is often taken as an opportunity to look back. For CUTEC 2015 was a special year. We acquired some interesting and challenging projects, and were represented at important scientific events. We celebrated our Summer Festival in the company of friends, sponsors and business partners. It was a special occasion, marking CUTEC's 25th anniversary. In the course of those years, we have succeeded in keeping pace with economic and new scientific and technical challenges based on continuous advancement.

Following on from the exciting early years under the leadership of Prof. Leschonski, CUTEC has achieved successful growth under Prof. Carlowitz particularly through the development of third party-funded projects. We aim to keep doing what has brought us success in the past. But, as the past 25 years have shown, we can only maintain that success by adapting and adopting new approaches where necessary. Prof. Faulstich oversaw the necessary strategic reorganisation, shifting towards the field of energy and resource efficiency. The aim now is to achieve some initial successes in implementation over the coming years. We are convinced that, with our outstanding expertise, and working from our regional base, we will be in a position to make an even greater contribution to the resolution of challenging scientific issues in relation to industrial energy systems and strategic raw materials for the transition to renewable energy use, and thereby also sustain CUTEC's growth. To that end, in 2016 we will be continuing our already very successful involvement in public-sector research projects as well as substantially boosting our collaboration with small and medium-sized enterprises, in order to carry forward the successes of our first 25 years into the future.

I very much hope you enjoy reading this issue, and would like to take this opportunity to thank all CUTEC's business partners, friends and sponsors for their loyalty and cooperation.

I wish you and your family a happy new year!

Best regards,

Martin Eberhardt

CUTEC is a Company of the State of Lower Saxony

8. LOWER SAXONY FUEL CELLS AND BATTERIES SUMMER SCHOOL

"Super event"

Group photo with participants and speakers (source: V. Schöber)

The CUTEC Institute hosted the eighth "Lower Saxony Fuel Cells and Batteries Summer School" in cooperation with the Leibniz University of Hanover. Some 40 young engineers and scientists attended the event held in the University's main building between September 21st and 25th. They were able to gain first-hand insights into the interesting and highly topical issues surrounding fuel cell and battery technology. Prof. Richard Hanke-Rauschenbach and Prof. Stephan Kabelac from the Leibniz Energy 2050 Research Centre at the Leibniz University of Hanover and Dr. Andreas Lindermeir from CUTEC welcomed the participants and officially opened the Summer School.

In the course of the week-long event, experts from the fields of science and industry presented papers on the theory and practice of fuel cell and battery technology, as well as outlining the latest research and development methodologies. First, scientists from the state of Lower Saxony lectured on the fundamentals of electrochemistry, thermodynamics, material science and energy technology. Then speakers from industry outlined some of the research and development work being undertaken. In addition to major corporations such as Volkswagen AG, Siemens AG, IAV GmbH, Vaillant GmbH and Johnson Controls GmbH , the event once again attracted representatives from smaller but high; innovative companies such as Eisenhuth GmbH, one of Europe's leading manufacturers of bipolar panels, and new enerday GmbH, a manufacturer of compact fuel cell systems. Practical experiments on fuel cells and batteries, a discussion round, and arithmetic calculation exercises provided the necessary variety within the programme. There was also an entertaining programme of accompanying activities, including a barbecue evening, a guide tour of the city, and a dinner at which the participants had the opportunity to engage with the event's speakers on scientific and technical matters, or just for a relaxed chat, in a convivial ambience.

After a richly rewarding week, having gained lots of new knowledge but also having had fun and made new contacts, the participating students were unanimous in their praise of the event: "A very good event"; "super organisation"; "a wonderfully constructive atmosphere"; and "expectations more than surpassed" were just some of the positive feedback comments received. All welcomed the idea that the Summer School should be a recurring event, so plans for 2016 are already under way.

Special thanks go to this year's hosts and co-organisers Prof. Richard Hanke-Rauschenbach and Prof. Stephan Kabelac from the Leibniz Energy Research Centre 2050 (LiFE 2050) at the Leibniz University of Hanover, and to the sponsors from industry and the scientific community (EWE AG, DOW Deutschland Anlagengesellschaft mbH, IAV GmbH, Volkswagen AG, Technical University of Braunschweig, and Ostfalia University of Applied Sciences), without whose financial support the event would not have been possible. (li)

Intensive discussions during the coffee break (source: A. Lindermeir)

GOSLAR ENERGY CONFERENCE 2015

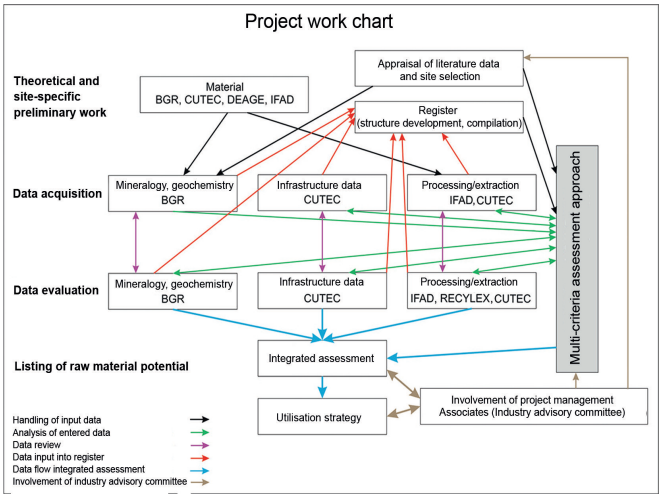
The eighth Lower Saxony Energy Conference was held between September 30th and October 1st, 2015 in Goslar. The keynote topic of this year's event was: Energy markets and the potentially conflicting priorities of government policy, public concerns, and competition. The first day, held in Goslar's Imperial Palace (Kaiserpfalz), was devoted to presentations relating to two different aspects. The first block considered the question: How much state intervention is needed in energy markets? All the speakers called for reliability in energy policy. Their perspectives – as representatives of the political sphere, the utilities sector, the primary materials industry, and energy users – did differ however. The second block considered the question: Is the heat market a stepchild? In addition to outlining the status quo, a number of interesting insights were given into the heat market in Denmark. Further efforts are needed in order to achieve a successful transition in the heating energy sector however. On the second day of the event a choice of five forums was offered. In conclusion, all the participants from the various forums came together to collate the results of their discussions. CUTEC was represented on both days by staff from the Energy System Analysis and Chemical Energy Systems departments. The Institute also provided an exhibition stand as an information resource for conference attendees. (sie)

HTMet: NEW RESEARCH PROJECT FOR THE DEPARTMENT OF METAL RECYCLING

On September 1st a new 36-month joint project was launched on the subject of "Metals in German sulphidic non-ferrous metal ores relevant for high-tech applications – Estimation of resource potential" (designated "HTMet" for short). The project is being funded as part of the

German Federal Ministry of Education and Research (BMBF) "r⁴ programme to promote new key strategic raw materials for high-tech industries in Germany, as part of its "FONA" sustainability research framework programme. The scientific contributors to the project consortium are the Federal Institute for Geosciences and Natural Resources (BGR), which is also responsible for the project's coordination through Dr. Graupner; the Institute for Mineral Processing, Waste Disposal and Geomechanics of the Technical University of Clausthal (IFAD); the Department of Applied Geosciences and Geophysics of the Montanuniversität Leoben in Austria (DEAGE), and the CUTEC Institute's Department of Metal Recycling. The industrial project partner is Recylex GmbH based in Goslar.

As a highly developed industrial nation, Germany has a substantial and most likely rising demand for raw material metals. Since there has been practically no mining of primary metal ores in Germany since 1992, most of the metals needed by industry are imported as concentrates or interim products. The European Commission's Ad-Hoc Working Group on Defining Critical Raw



Schematic overview of the research work package schedule on the joint project (source: BGR)

Consortium prior to entering the Walchenberg mine (source: BGR)

Materials has defined 20 mineral raw materials as critical for the EU based on their supply risk and economic importance. They include the elements germanium, gallium, indium and antimony which are important for high-tech applications, as well as fluorite of adequately high quality, all of which are to be considered as part of the HTMet project. The largest producer of all the aforementioned HT metals is China. German industry is therefore extremely dependent on that source, and as such vulnerable to regulatory policies imposed by the Chinese government in support of its own industry. A consequently necessary diversification of sourcing of HT raw materials includes the use of domestic resources. However, the lack of interest on the part of German industry in engaging in its own mining operations in the last two decades means that there is currently no systematic working of ore deposits in Germany. This is true especially with regard to HT metal content in mineralised non-ferrous metals in Germany and neighbouring EU regions applying the new possibilities of trace element analysis and processing. Utilising the trace elements in domestic ores can be expected to play a key role in improving the security of supply to German high-tech industry of raw materials. Consequently, the HTMet project will pursue the following specific goals:

- Development and presentation of a geochemical/mineralogical / industrial register (designated GMWK) providing the most complete possible record of the presumable occurrence of HT metals in non-ferrous metal ores by genetic type.
- Profiling of the mineralogical and chemical composition of the ores in order to determine their potential usefulness, paying special attention to trace metal management.
- Creation and application of a multi-stage concept to assess the potential of mine locations for resource-efficient recovery of the ores.
- Exemplary modelling of economically viable processing of the ores. Laboratory experimentation on trace metal rich sulphidic ores will test, adapt and develop innovative methodologies for mining technologies. The focus of the experimentation will be on optimising the yield of all useful components (primary and trace metals, lode categories, building materials) on a laboratory scale.

CUTEC's Sven Birkenfeld and Dr. Torsten Zeller are looking forward to contributing to this ground-breaking project.

The first large-scale sampling operation was undertaken in October at the Walchenberg mine in Austria. Scientists from CUTEC, the IFAD and the BGR recovered approximately one tonne of sample material for the planned processing experiments. Ore samples were also retrieved directly in the adit, in order to generate data on the deposit site based on more detailed analysis.

CUTEC would like to thank the BMBF for its grant funding of the project, and looks forward to a successful implementation phase. We will be reporting here on the further progress of the project. (bir/ze)

VDI AWARD FOR SINN POWER WAVE TECHNOLOGY

Association of German Engineers (Verein Deutscher Ingenieure, VDI) recognises CUTEC project as best engineering start-up of 2015

Prof. Dr. Peter Pfeffer, Chairman of the VDI Munich regional organisation, with award-winners Martin Bednarz and Philipp Sinn, and VDI jury member Prof. Dr. Hartmut Hoffmann (from left)

At a ceremony held on October 29th, CUTEC start-up SINN Power was presented with the 2015 VDI Award in recognition of its innovative solution for the use of ocean waves to generate power, and of the special economic significance and social relevance of the project.

The jury stated that the decisive factors in nominating the founders for the award were the highly promising business idea and, in particular, the entrepreneurial spirit driving the young engineering start-up. Representing the team, the two founders Philipp Sinn and Martin Bednarz presented the simple but efficient concept of the wave energy converter to the approximately 200 invited guests at the award ceremony.

Sinn regards the award primarily as an incentive: "To create an engineering start-up, you not only need a good idea, but also have to be fully committed to realising it. We will be continuing our hard work to ensure that the wave energy converter is a success and our business grows sustainably." Head of Technical Development Bednarz is particularly keen to praise the accomplishments of the now more than 20 engineers working on the project: "A year ago the wave power plant existed only on paper; now the first module is just being set up for a test in the ocean. This award belongs to the entire team."

The Award by the VDI's regional organisation covering Munich, Upper and Lower Bavaria recognises engineering accomplishments in all technical and scientific fields. Its primary aim is to make the accomplishments of the award-winners known to the public at large. As one outcome, for example, SINN Power will be profiled in the magazine "Technik in Bayern" [Engineering in Bavaria], which has a regular readership of 24,000. (sn/br)

The concept underlying the SINN Power wave energy converter impressed the VDI Munich jury

SUCCESSFUL WAVE TANK TESTS IN FLORENCE

What happens when a seven metre high breaking wave hits the SINN Power wave energy converter? That was what the SINN Power team was able to observe back in early September in the wave tank at the University of Florence. The engineers had placed a miniature 1:18.5 model of the technology in the wave channel. A variety of different scenarios could then be simulated: Regular small waves demonstrate how the plant works in normal operation. But real "breakers" can also be created, testing the mooring system of the model wave energy converter to its limit.

The data obtained is currently being analysed with the aid of a team headed by cooperation partner Lorenzo Cappietti at the University of Florence. The results will primarily help SINN Power to further enhance the stability of the wave energy converter in storm conditions. The tests will also provide information on the hydromechanical behaviour of the float geometry in different wave scenarios. As a result, the team has already been able to specify maximum loads for individual geometries.

Lorenzo Cappietti (l.) from the University of Florence with CUTEC project manager Philipp Sinn preparing for the wave tank test

The findings from the wave tank tests will also be used to verify of the simulations of the wave energy converter. The simulation tool, presented by CUTEC doctoral candidate Thomas Knapp at the SCACR 2015 conference at the University of Florence in late September, can calculate the amount of power generated in various wave conditions, and so will in future enable the converter to be optimally customised to different locations. (sn/br)

INVESTIGATION OF POSSIBILITIES FOR THE OPTIMISATION OF ENERGY CONSUMPTION AND MANAGEMENT IN FOOD PRODUCTION

The project investigated, based on the example of food manufacturer Bruno Gelato GmbH, how the consumption of electricity, natural gas and supercooled liquid nitrogen can be reduced in order to improve profitability and to cut production-related CO^2 emissions.

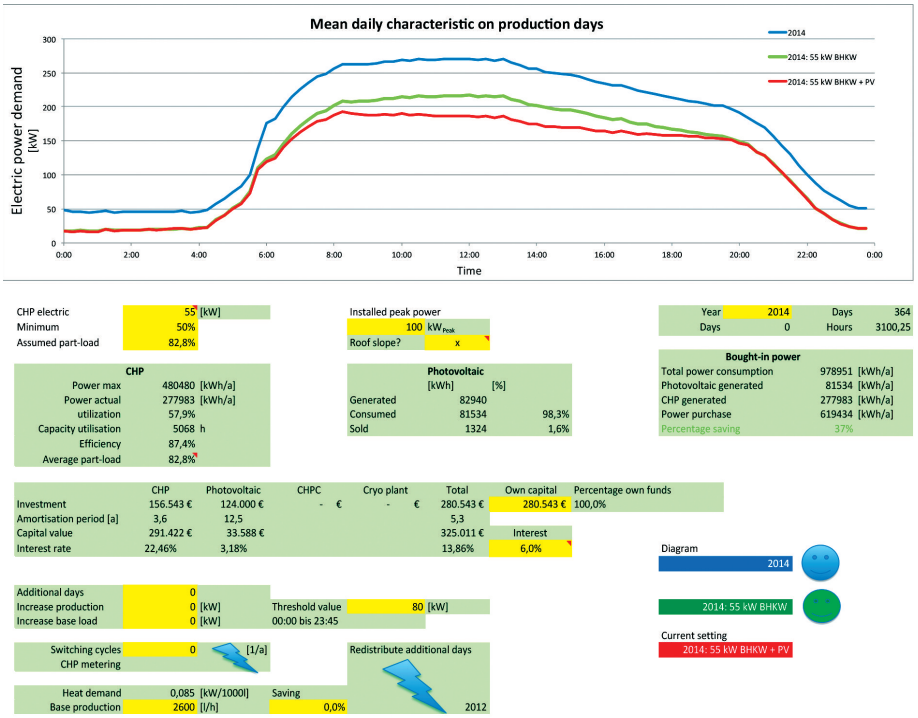
The production of ice-cream is a comparatively energy-intensive process, in which the chilled milk supplied is initially heated up to pasteurisation temperature in a multi-stage process and then shock-frozen after passing through the ice machine.

As the basis for process optimisation, consumption data from the last three years was collated and supplemented by evaluation of in-house meters. The electricity and heat consumption figures were grouped into typical daily load curves, representing days with and without production respectively, and depicted in a process model.

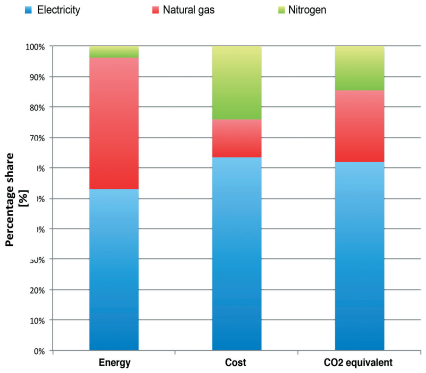
In this way, the potential for optimising single measures and combinations of measures could be identified on the basis of robust, timed data. Proposed improvements to energy supply were centred on a natural gas fuelled combined heat and power (CHP) plant and a photovoltaic (PV) plant. As the electric power is used primarily to cool the store rooms by means of compressors, the proposed concept incorporated not only co-generation (CHP) but also tri-generation of combined heat, power and cold (CHPC).

The CHPC plant does not attain the low temperatures necessary for shock-freezing however. So it is not able to replace the existing practice of using liquid nitrogen. The cooling energy of the nitrogen represents only a small portion of the total energy consumption, but accounts for a high percentage of the overall cost and of the CO^2 emissions.

A thermodynamically advantageous substitute for the use of liquid nitrogen is a so-called cryogenic Stirling engine. However, the use of innovative cryogenic technology entails high investment cost, and so in the present case is unfeasible due to the combination of the small scale of the business and the only partial capacity utilisation (production break in winter; no three-shift operation).



Simulation tool for economically viable energy supply
Blue line: External power supply, actual | Red line: External power supply with CHP
Green line: External power supply with CHP and PV



Comparison of the energy sources used in the company being studied (starting situation)

Potential for improvements in heat integration were identified on the basis of a pinch analysis. This plots warm and cold flows together in a chart in order to determine the ideal heat integration. A comparison of the heating and cooling demands of related temperature levels revealed significant potential for savings by heat exchange. As the production is a batch process, the heat needed for it is stored in the times between the various batches.

The Cleaning in Place (CIP) process can be improved in the same way.

The single measure entailing the biggest annual reduction in CO^2 emissions is tri-generation (combined heat, power and cold, or CHPC). However, there is currently no additional CHPC plant available on the market in the power class required here. As expected, thanks to their simple design, the greatest cost-specific carbon dioxide savings potential, expressed in emissions reduction per Euro per year, is offered by heat exchangers and stores. Recommended economically and technical feasible solutions are a power-optimised CHP plant and a combination of heat exchangers and stores in the production and cleaning facilities.

The simulation tool created in this project can be flexibly upgraded, including for application in other sectors. A particularly interesting possibility, beyond CHP and PV, appears to be identification of the potential offered by CHPC and specialised supercooling technologies. (ke)

COMPLETION OF THE ELPASO PROJECT

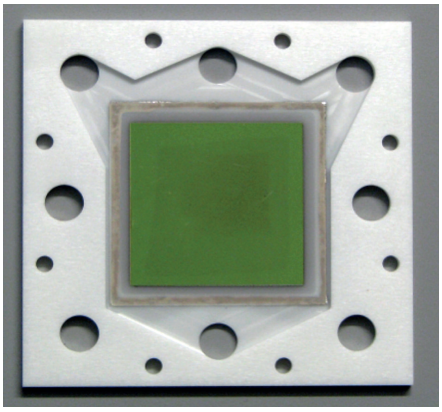
Performance test for the innovative Clausthal SOFC stack design

The Clausthal project team, including representatives of the Institute of Metallurgy (IMET) and the Institute of Welding and Machining (ISAF) of the TU Clausthal and of the CUTEC Institute, has taken on the herculean task of developing its own design for a solid-oxide fuel cell (SOFC).

The SOFC is a high-temperature fuel cell operated at 650 to 1000 °C. Its core element is an oxygen ion conducting electrolyte which is mostly executed as a thin planar membrane made of a ceramic material. The active electrodes are applied as a thin layer on both sides of the electrolyte. This composite structure is termed a (single) cell.

As a single cell only delivers a voltage about 1 Volt, multiple cells are interconnected, usually in a serial configuration. To do so, the sensitive cells are inserted in a steel or ceramic frame and joint together by conductive contact plates (interconnectors) to create a stack. Due to the high temperatures, and in order to avoid internal short-circuits, isolating glass sealants are common for jointing and sealing, though they tend to embrittlement and cause degradation of SOFC stacks.

A disadvantage of the serial configuration is that the single cells have different voltages during operation due to production tolerances or variations in local operating conditions. Cells with inadequate voltages tend to degrade faster, resulting in a further voltage drop over time. This self-destroying mechanism leads to the total failure of single cells. In this way a further disadvantage of the serial configu-

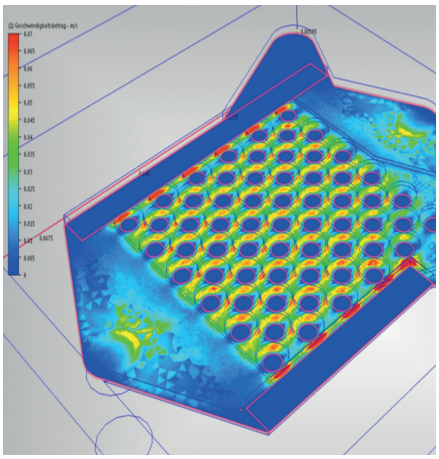


Ceramic frame with brazed-in cell (source: IMET)

ration is revealed: like a chain of lights on a Christmas tree, a single faulty bulb (cell) results in total failure of the entire chain (stack) – and the tree remains unlit! The same effect occurs in the stack, with the key difference that it is not possible to change single cells. So if one cell fails, the entire stack must be replaced.

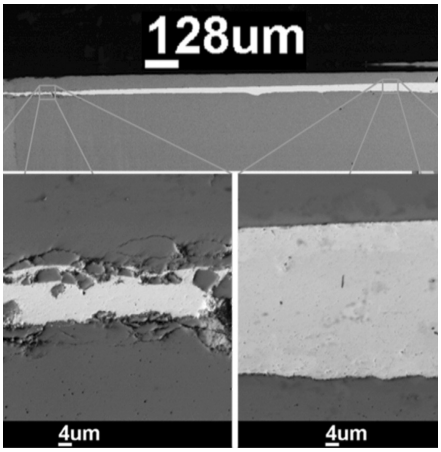
The Clausthal partners have therefore developed a new stack concept based on electrically parallel connection of the single cells which avoids the aforementioned problems. The concept of the "electrically parallel SOFC" also provided the inspiration for the project title: "ElPaSO". It is based on repeating units with two parallel-configured cells (picture at bottom left). Key factors in the design and construction process were the allowed tolerances of the various components, their different thermal expansion coefficients, and chemical aspects of the material matching. For the cell frames and the housing both a fully ceramic concept (picture above centre) and a metallic version made of ferritic steel were developed. In both cases the cells were brazed into the frame by using a special brazing technique called RAB (reactive air brazing). This enables a permanently gas-tight bonding even at high temperatures without using glass sealants.

During the project both a ceramic and a metallic mini-stack have been build up and tested (picture centre right). The fully ceramic stack proved its durability in a 1200-hour endurance test. When the critical joint between cell and frame was examined with SEM at the end of the testing a surprise appeared: The used silver braze not only withstood the



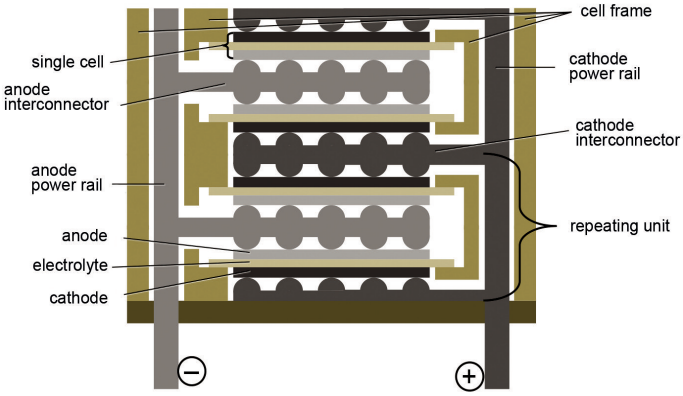
Flow simulation at cell level (source: CUTEC)

reducing and oxidising gases, but also even filled out minor cracks in the ceramic frame and thereby "healed" and stabilised the joint (picture bottom right).



REM image of the RAB brazing at the end of the endurance test (source: ISAF)

These results have encouraged the project team to undertake a follow-up project, which is currently in preparation. We will keep you posted... (im/sz)



Basic concept of the ElPaSO stack (source: CUTEC)

CUTEC ON THE ROAD

IFAT ENVIRONMENTAL TECHNOLOGY FORUM AFRICA IN JOHANNESBURG

From September 15th to 18th, 2015 the IFAT Environmental Technology Forum Africa was premiered in Johannesburg. With visitors from 42 countries, IFAT is centred strongly on the African market.

The Messe München Munich trade fair and exhibition centre has now also established very successful international branch operations in Ankara, Mumbai and Shanghai.

CUTEC Managing Director Martin Faulstich opened the event's accompanying programme on the first day, taking on the role of moderator and presenting a paper titled "Recycling – Chances, Challenges, Solutions". The second day, likewise moderated by Faulstich, was hosted in cooperation with the German Federal Ministry for Economic Affairs and Energy, and the export initiative RETech German Recycling Technologies and Waste Management Partnership.

Prof. Faulstich opened the accompanying programme at the IFAT event in South Africa

Faulstich has long been associated with the event organisers, as a member of the IFAT executive board and as chairman of the advisory board of the export initiative.

Many companies were clearly impressed by IFAT South Africa, and have already announced that they plan to attend again in 2017. The next "classic" IFAT will take place from May 30th to June 3rd, 2016 back in Munich. And the CUTEC Institute will be there again, too, of course. (fa)

INTERNATIONAL DGMK CONFERENCE IN DRESDEN

From October 7th to 9th the German Scientific Society for Mineral Oil, Natural Gas and Coal (DGMK) played host to a conference which attracted 120 visitors to the Dreikönigskirche church building in Dresden. The attendees came from Germany, Italy, Austria, Russia, the UK, and even from China and the USA. 9 keynote and 14 accepted papers were presented, and 22 posters displayed. The scientific organising committee was composed of leading representatives from universities and major companies. Accordingly, the presentations made were on a mix of application-oriented and more scientifically focused topics. In general terms, the conference presented a wide range of activities relating to heterogeneous catalysis

Dr. Stefan Vodegel during his presentation

in the field of hydrocarbon research, which is currently a very hot topic internationally. Dr. Stefan Vodegel reported on the experiences of the Department of Thermal Processes in the production of synthesis gas from thermochemically difficult biomasses such as straw, fermentation residues, switch grass and the like. The material input at a rate of 60 to 80 kg/h in continuous trial running mode attracted a number of questions. The presentation was conceived as an overview outlining results from various projects in recent years. The subject of thermal nutrient recovery was highlighted in particular. (vo)

47. POWER PLANT ENGINEERING COLLOQIUM IN DRESDEN

The 47th Power Plant Engineering Colloqium was held on October 13th and 14th in Dresden. This year's again highly successful event was attended by more than 700 people. In the Poster Session the CUTEC Institute presented its project "Flexibility demands imposed on conventional power plants in the European market", a cooperation project with industrial partner General Electric (formerly Alstom Power).

Contributions from players in the energy industry and energy research, grid operators, power plant operators and component manufacturers helped provide a comprehensive overview of current technical aspects as well as policy-related issues in the sector. The keynote topic this year was again the need to make conventional power plants more flexible with a view to ensuring secure operation of the European grid. The increase in the number of redispatch measures is of major importance both for grid operators and for power plant operators. Consequently, numerous presentations reported on the implementation of flexibility improvement measures at existing power plant sites. Optimisation of firing processes, new ignition technologies and new methods of process simulation were proposed. A second area of focus was on emissions reduction concepts, primarily with regard to NO_x emissions. This year there was also intensive discussion on the use of energy stores at combined heat and power plants and gas and steam power plants as a means of enhancing flexibility. This demand results from the fact that the current volatility of electricity prices often no longer allows costs to be covered in heat-controlled operation. (ku)

DIARY

- IFAT 2016, May 30th to June 3rd, 2016, Munich Exhibition and Trade Fair Centre.
  Visit us on the joint stand of the German RETech Partnership in hall B2, stand number 541.

CUTEC ON THE ROAD

27. VDI / ITAD THERMAL WASTE TREATMENT CONFERENCE IN WÜRZBURG

Representatives from the waste management industry gathered in Würzburg on October 1st and 2nd to discuss new legal and technical developments at German national and European level. The conference chairs were the president of the Brussels-based CEWEP (Confederation of European Waste-to-Energy Plants) Ferdinand Kleppmann and Michael Theben from the state of North Rhine-Westphalia Ministry for Climate Protection, Environmental Affairs, Agriculture, Nature and Consumer Protection in Düsseldorf. The conference was well attended, with some 150 people taking part. Dr. Stefan Vodegel was invited to make a presentation on "Material flow potential for waste incineration". In it, he set forth the results of an almost completed project run by the German Environmental Agency UBA which is currently attracting great interest. Invitations to present papers at the 2016 event have already been received. The new "Studies and Policy Advice in the Waste Management Sector" section of the Department of Thermal Processes has also got off to a flying start with some additional projects. (vo)

PROJECT ASHES MEETING IN BRAZIL

From left: F. Müller (CUTEC), H. Herzel (BAM, Berlin), Dr. A. Campos Cuellar (Fraunhofer IGB, Stuttgart), Dr. S. Schrey (FZJ), Dr. M. Schweizer (TECNARO), M. Meiller (Fraunhofer UMSICHT, Sulzbach-Rosenberg), M. Strauss (CNPEM LNNANO, Campinas), V. Damin (UFG, Goiania), Dr. H.-J. Gehrmann (KIT ITC), L. Hermann (Outotec)

A Project Ashes meeting was held in Brazil in the last week of September. Brazilian and German partners gathered to come up with possibilities for the closing of the nutrient cycle in sugar cane cultivation. The ashes and residual materials occurring in the processing of sugar cane into sugar and ethanol will be analysed to ascertain their suitability as a nutrient supplier for plants.

Following an internal project meeting, a workshop was held in São Paulo attended by large numbers of representatives from Brazilian industry, research and bioenergy platforms. Felix Müller from the Department of Thermal Processes was given the opportunity to make a brief presentation on the CUTEC Institute and its tasks within the project. A concluding discussion enabled a number of useful ideas and tips to be collated and exchanged. At the Centro Nacional de Pesquisa em Energia e Materiais (CNPEM) in Campinas discussions were held on current research projects at the various institutes located there. The trip was rounded off by a tour of a sugar cane processing plant. This provided insights into the processing of the sugar cane and utilisation of the materials occurring as a by-product of the product. (mü)

NEWS FROM THE CUTEC TEAM

Congratulations…

… to Torsten Reindorf on being appointed Professor at the Hochschule Trier. He will be teaching at that institution's "BLV" faculty, in the department of Building Services Engineering, Utility Supply and Energy Technology, covering subjects including plant engineering, technical mechanics and heat transfer. He previously worked in our Department of Thermal Processes for almost 15 years, focusing on the field of emissions treatment.

During this time with us, he progressed through the posts of student auxiliary, graduate student, project executive and project manager, as well as obtaining his doctorate cum laude, and ultimately becoming deputy department head. His advancement to professorship is thus the next logical and inevitable step.

Prof. Torsten Reindorf received his certificate of appointment from the Hochschule Trier on October 1st, 2015

We are delighted at Torsten Reindorf's continuing career success, and wish him all the best for the future. (vo)

IMPRINT

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